Aalto University
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CHILDREN AND GENDER INEQUALITY: EVIDENCE FROM FINLAND

Master's Thesis
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Abstract of master's thesis

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Abstract

This thesis studies the impact of the arrival of the first child on the labor market outcomes of women and men in Finland. Using Finnish registry data from 1988-2015 on parents who had their first child between 1993-2005 and an event study method I show that the impact of children on women is negative, large and persistent while men are almost completely unaffected. Up to five years before the birth of the first child there is little difference in labor market outcomes of men and women, but one year after the birth women's annual labor earnings drop by 61 %, total annual income by 30 % and participation rate by 26 % compared to year before the birth. The child penalty, the percentage by which women fall behind men due to children, in annual labor earnings after ten years equals to 21 %, 10.4 % for participation rate and 16.9 % for total annual income. The child penalties are persistent for all three outcomes even 20 years after the birth. When comparing men with and without children there is no visible difference in the development of labor market outcomes but women with children experience significant a drop in earnings and participation rate compared to women without children.

Keywords Gender wage gap, Children, Wage gap, Finland, Economics

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Tämä pro gradu -tutkielma tutkii ensimmäisen lapsen vaikutusta miesten ja naisten työmarkkinalopputulemiin Suomessa. Tutkielmassani käytän suomalaista rekisteridataa vuosilta 1988-2015 suomalaisista vanhemmista jotka saivat ensimmäisen lapsensa vuosien 1993 ja 2005 välillä ja event study -menetelmää, jonka pohjalta osoitan että lapsensaannin vaikutus naisten työmarkkinalopputulemiin on negatiivinen, suuri sekä pysyvä. Samaan aikaan lapsensaannin vaikutus miesten työmarkkinalopputulemiin on melkein olematon. Viiden vuoden aikavälillä ennen ensimmäisen lapsen syntymää miesten ja naisten työmarkkinalopputulemissa ei ole merkittäviä eroja mutta vuosi ensimmäisen lapsen syntymän jälkeen naisten työtulot putoavat 61 %, ansiotulot 30 % ja osallistumisaste 26 % verrattuna vuoteen ennen lapsen syntymää. “Child penalty”, prosenttiosuus jonka verran naiset putoavat miesten taakse lastensaannin takia, työtuloissa kymmenen vuotta ensimmäisen lapsen syntymän jälkeen on 21 %, 10.4 % osallistumisasteessa ja 16.9 % ansiotuloissa. Lapsensaannilla on negatiivinen vaikutus äitien kaikkiin kolmeen työmarkkinalopputulemaan jopa 20 vuotta ensimmäisen lapsen syntymän jälkeen. Työmarkkinalopputulemissa ei ole huomattavia eroja verrattaessa miehiä jotka saivat lapsen miehiin jotka eivät hankkineet lapsia, mutta naiset jotka hankkivat lapsia jäivät huomattavasti jälkeen työtuloissa ja osallistumisasteessa verrattuna naisiin jotka eivät hankkineet lapsia.

Avainsanat Tuloerot, Lapset, Sukupuolten väliset tuloerot, Suomi, Taloustiede

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Abstract

This thesis studies the impact of the arrival of the first child on the labor market outcomes of women and men in Finland. Using Finnish registry data from 1988-2015 on parents who had their first child between 1993-2005 and an event study method I show that the impact of children on women is negative, large and persistent while men are almost completely unaffected. Up to five years before the birth of the first child there is little difference in labor market outcomes of men and women, but one year after the birth of womens' annual labor earnings drop by 61 %, total annual income by 30 % and participation rate by 26 % compared to year before the birth. The child penalty, the percentage by which women fall behind men due to children, in annual labor earnings after ten years equals to 21 %, 10.4 % for participation rate and 16.9 % for total annual income. The child penalties are persistent for all three outcomes even 20 years after the birth. When comparing men with and without children there is no visible difference in the development of labor market outcomes but women with children experience a significant drop in earnings and participation rate compared to women without children.

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1 Introduction

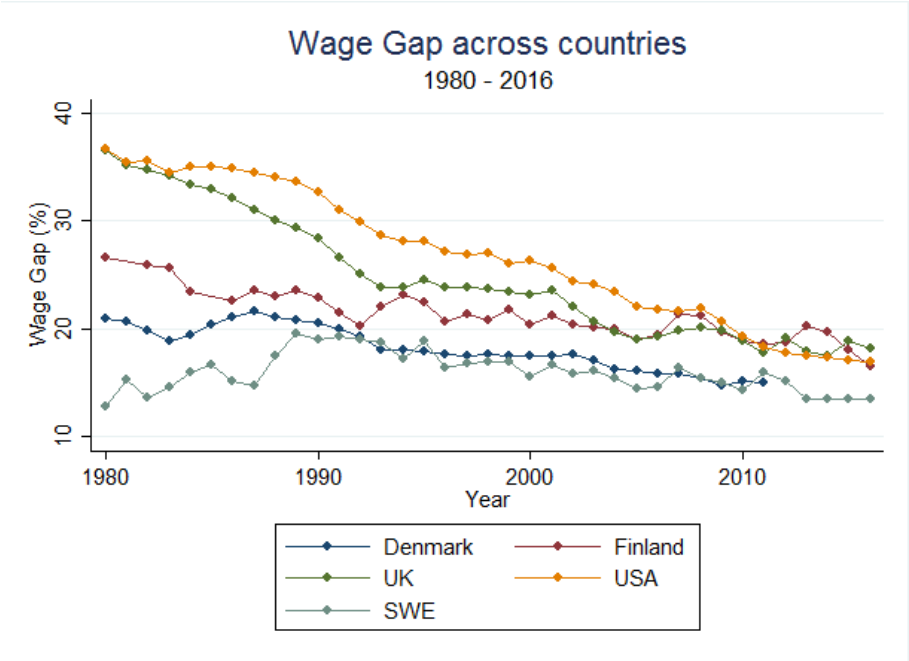
The objective of my thesis is to study whether there is a link between the birth the of first child and the wage gap between men and women in Finland, and how large and persistent the effect of children is on different labor market outcomes. I follow the empirical approach of Kleven et al. (2018) in studying this phanenom, an approach based on event studies around the birth of the first child to estimate the impact of children on different labor market outcomes, such as earnings and participation rate.

In my event study analysis my main focus is on three different labor market outcomes, annual labor earnings, participation rate, and total annual income, and how these outcomes develop five years before and ten years after the birth of the first child for men and women who had their first child between 1993-2005. My results show that for men all these outcome variables remain almost unaffected by the arrival of children whereas women face a significant drop in earnings and participation rate after the birth of the first child. The gap between men and women created by children doesn't close during the ten, or even twenty year period after the birth. One year after the birth womens' annual labor earnings drop by 61 %, total annual income by 30 % and participation rate by 26 % relative to one year before the birth. Ten years after the birth the child penalty, the percentage by which women fall behind men due to children, in annual labor earnings is 21 %, 10.4 % for participation rate and 16.9 % for total annual income. The striking fact is that women fall behind men in earnings and other outcome variables every year after the birth.

During the last century, there has been a convergence between men and women in labor market outcomes such as labor force participation, earnings and occupations (Goldin 2014). Despite this fact, differences between men and women in earnings continue to be substantial in all countries and the process of closing the gap has decreased (Kleven et al. 2018). The Nordic countries are characterized by having a high female labor force participation and a generous social insurance system attempting to reduce inequality in the labor market (Angelov et al. 2016), which could imply smaller differences and greater equality between men and women. I used data from OECD[1] in figure 1 to plot the development of the gender wage gap in Finland, Denmark, Sweden, USA and the United Kingdom between 1980 and 2016. The gender wage gap is defined by OECD as the difference between

[1]data retrieved from `https://data.oecd.org/earnwage/gender-wage-gap.htm#indicator-chart`

Figure 1: The development of wage gap across countries between 1980-2016 (OECD)



the median earnings of men and women relative to median earnings of men. Data refers to full-time employees and to self-employed individuals.

Figure 1 shows that the gender gap in earnings is still substantial in Finland and that it is no longer very different from the gender gap observed in the United States and the UK. The gender inequality in earnings in Finland used to be well below those of the US and the UK but today the gender pay is currently between 15-20 % in all three countries and appears to have stabilized at that level. Despite the presence of very different public policies and labor markets in these countries, the gender gaps in these countries are converging over time. My thesis shows that possibly a major part of this remaining gender wage gap is caused by children.

The rest of this paper is as follows. Section 2 reviews economic literature regarding wage gap between men and women and the impact of children, Section 3 Describes institutional setting, Section 4 & 5 describes the data and descriptive statistics and Sections 6 and 7 set the empirical framework for the main analysis and presents the results, Section 8 compares the results from my thesis to results from Denmark and section 9 concludes and provides some discussion regarding possible policy interpretations.

2 Children and gender inequality

My paper contributes to the economic literature relating to the impact of children on the labor market outcomes of parents. The advantage of my paper is the rich administrative data on individuals' labor market activities and background information. Some of the previous studies conducted in the subject have either used smaller sample sizes or focused on a particular group, for example, Bertrand et al. (2010) studied the impact of children on MBA graduates from one business school in the US. Some studies, for example, Angrist & Evans (1996) and Bronars & Grogger (1994), have used an instrumental variable approach with twin births or sibling sex-mixes as the source of exogeneity to study the impact of children. A more recent paper by Lundborg et al. (2016) from Denmark used an instrumental variable approach based on in vitro fertilization (IVF) to estimate the causal impact of children on mother's career outcomes. While these approaches measure the local treatment effect of an additional child, my contribution is to measure the global treatment effect of all children in the population, most importantly the impact of the first child. This section covers selected economic literature that have studied the impact of children on the gender wage gap.

The main question of my thesis is how large and persistent are the child penalties on women's earnings compared to men. Results from other Nordic countries are particularly interesting for my thesis since these countries share similar institutional and cultural environment. The closest paper to my thesis by approach and data is the one by Kleven et al. (2018). In my thesis I follow their empirical approach and I am able to follow quite accurately their method mostly due to the fact that there are similar vast national individual-level data on parents, their labor market outcomes as well as information on childbirths available in Finland and Denmark. Their focus is on the impact of children on gender wage gap in Denmark, following the evolution of labor market outcomes including annual earnings, hours worked, participation rate and wage rates before and after the birth of the first child. Up to five years before the birth of the first child, men and women in Denmark have almost the same trend in all outcomes, but in the years just after the birth, the earnings of women drop on average by 30%. According to Kleven et al. this 30% gap is driven in part by labor supply adjustments, as women take the majority of the parental leave granted to Danish parents. But interestingly the earnings of women relative to those of men ten years after the birth of the first child is almost 20 % smaller. As sources of this earnings gap, they find that women adjust several margins of their behaviors in the labor market, such as occupation, working more part-time work and changing their career track after the arrival of

children, while men do not. They find that children affect the job characteristics of women relative to men. In Denmark, after the birth of the first child women switch jobs to firms that are more "family friendly" proxied either by working in the public sector or by having women with young children in the management, favoring family amenities over pecuniary rewards. In a recent working paper, Kleven et al. (2019) followed up on the paper by Kleven et al. (2018). They used the same approach as Kleven et al. (2018) to study child penalties in Denmark, Sweden, Germany, Austria, the United Kingdom, and the United States. The results show that in each of these countries the impact of the arrival of the first child on women is large and persistent and men are almost completely unaffected by the event. However, they find that the long run child penalties are the largest in Germany and Austria, 50-60 % after ten years compared to 20-30 % in Scandinavia. They state that more generous parental leave and other family policies in Sweden could explain why the short run child penalties are larger in Sweden compared to Denmark, as these policies encourage mothers to extend their absence from the labor force. As an explanation for the large long-run penalties in Germanic countries Kleven et al (2019) suggest that these countries are characterized by more conservative gender views, pointing towards the importance of gender attitudes and norms in reducing the long run gender gap created by children. Another study using a similar approach and data by Angelov et al. (2016) estimated the short- and long-term effects of having children on the earnings gap between women and men in Sweden. They used Swedish administrative data to study the evolution of parents incomes and wages few years before and 15 years after the birth of the first child, essentially using the same approach that I use in my study. They find that 15 years after the first child was born, the gap between parents income increased by 32 percentage points and the gap between wages increased 10 percentage points compared to the gap before the birth of the first child.

The paper by Bertrand et al. (2010) uses a similar set-up but with smaller dataset focusing on a specific group of individuals. Their case study researched the explanations for the gender gap in labor market outcomes for highly-educated individuals, MBA graduates, between 1990 and 2006 in the US. After graduation, both men and women graduates have similar levels of income and work nearly the same hours but these trends diverge after the birth of the child and after 16 years there remains a significant gap between men and women. According to the authors, the arrival of children is the main reason for the lesser job experience, career interruptions and shorter work hours for female MBAs. Women with children have a nearly eight-month worth of career interruptions and work 24 percent fewer weekly hours compared to average man. At the same time, women without children only face 1.5-month interruptions and work 3.3 percent fewer hours. In Spain Fernandez-Kranz et al. (2013) estimated that the wage losses for mothers for the first child

on average is 9 %. Lundberg & Rose (2000) in their study state that mothers in the US faced a 45 % decrease in hours worked after the birth of the first child, and a 23 % decrease in wages after longer interruptions in labor market activity. At the same time, the hours worked and wage rates for the father's remained almost unaffected.

These studies reviewed in this section show that the arrival of children increases the earnings gap between mothers and fathers, but what are the margins that drive the gender gap in earnings. The reduced hours worked and an increase in part-time work for mothers after the birth of the child is well documented in the economic literature. Paull (2008) showed that in the UK the difference in hours worked between men and women before the birth of the child was small but increases after the birth. Women work more part-time and shorter hours while men's hours are almost completely unaffected by the arrival of children. In Denmark, women earn persistently less because of having children according to Lundborg et al. (2016). A major reason for this motherhood penalty, decline in hourly earnings, is explained by women moving to lower-paid jobs closer to home. A possible explanation for the difference in wages between women with children and without children could be driven by selection in firms. Fernandez-Kranz et al. (2013) found that after the birth of the first child, women in Spain are more likely to move to work in a more family-friendly firm for better work-life balance. Family-friendliness usually allows mothers to work shorter hours, part-time or for example stay at home with sick children. Fewer hours worked results in a decrease in earnings.

Based on the previous economic literature reviewed in this section, I could expect that the arrival of children has a negative effect on mother's labor market outcomes in Finland, but the interesting question is that how large and persistent the impact is.

3 Institutional setting

The Nordic countries have been praised for offering better opportunities for women to balance career and family than most other countries (Kleven et al. (2018); Angelov et al. (2016)). Statistics Finland reports that the labor force participation rate[2] for women in 2015 was 63.7 % whereas for men it was 67.4 % . According to Kleven et al. (2018) Denmark has one of the highest female labor force participation rates in the world, currently around 80 %, and almost no gender gap in participation rates, whereas in Finland the participation rate for both men and women is lower compared to Denmark and there is roughly 4 % gender gap in participation rate.

3.1 Family institutions in Finland

Finland has one of the most extensive childcare system's in the world. Mothers in Finland can choose to go on maternity leave earliest 30 to 50 days before the calculated day of birth. The maternity pays begins when the mother goes for maternity leave and continues until 105 days after the birth. The maternity leave continues for roughly three months after the birth. After the maternity leave parents can continue to take care of the child(ren) at home or use public or private childcare, which are both heavily subsidized. Fathers in Finland can take paternity leave for 54 days, roughly nine weeks, at most. Out of these 54 days three weeks can be spent home with the mother and the rest of the leave days can be used when the the family no longer receives a parental allowance. The paternal leave must be used before the child turns two years old. The parental leave can be used by either of the parent's, and it lasts for 158 days. KELA (The Finnish Social Insurance Institution) provides parental pay during the parental leave. The parental pay ends when the child is 9 months old. After the parental leave the parents can either stay at home and take care of the child, arrange private daycare which is subsidized by the state, work for up to 30 hours per week and get flexible care allowance or place the child in local daycare All children aged 9 months to 3 years are eligible for home care allowance (HCA). According to Kosonen (2014), this HCA system creates incentives to for mothers to stay at home, reducing labor supply incentives. In addition this system in Finland is very generous even when compared to other Nordic countries, and Kosonen states that the Finnish HCA incentives are on such a high level that even the high income parents are incentivized to stay home for

[2]Labour force participation rate = Labour force as a percentage of the population aged 15 to 74

longer time periods. In figure 2 I have summarized the benefits timeline received by the parents before and after the birth.

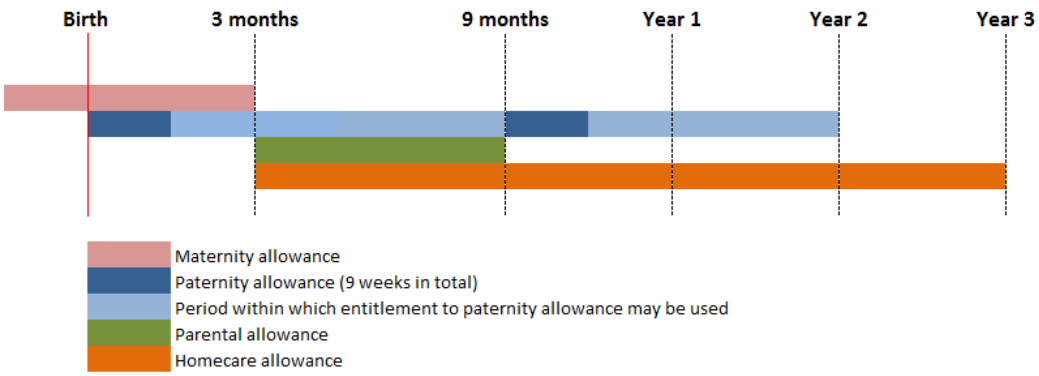


Figure 2: Family benefits in Finland before and after the birth of the child (Kela 2018)

3.2 Attitudes towards gender equality

The Finnish ministry of social affairs and health conducted a survey in 2017 titled equality barometer where they measured Finnish attitudes, opinions, and experiences towards gender equality in Finland. Full-time employees (n=797) were asked how well they think gender equality is actualized at their workplace. A fifth of the women feel that combining work and family has caused inconvenience. For men, only one in ten answered this caused some inconvenience. Participants working in the public sector answered that taking a parental leave was easier compared to answers of those who work in the private sector. Men working in the private sector experienced the most inconvenience in taking parental leave. Majority of participants answered that taking a day off work and taking care of the sick child was not difficult.

International Social Survey Program (ISSP) conducts surveys on diverse topics relevant to social sciences. In 2002 and 2012 they conducted a survey that included questions on the attitudes that people with and without children have regarding women working full-time part-time or not at all. In 2002 they had the following four questions:

1. Do you think that women should work outside the home full-time, part-time or not at all when they are married but with no children?

2. Do you think that women should work outside the home full-time, part-time or not at all when there is a child under school age?
3. Do you think that women should work outside the home full-time, part-time or not at all when the youngest child is still in school
4. Do you think that women should work outside the home full-time,part-time or not at all if the child has left home?

The 2012 survey only included two of those questions:

1. Do you think that women should work outside the home full-time, part-time or not at all when there is a child under school age?
2. Do you think that women should work outside the home full-time, part-time or not at all when the youngest child is still in school?

I have summarized the answers from the US, the UK, Denmark, Sweden, and Finland into figures A1-A6 in the appendices. These figures visualize the answers and attempt to shed some light whether there are significant differences in attitudes between the Nordic countries and the US and the UK. Y-axis is the share of answers for each country which adds to 100 % when adding up the shares for the three answers for each country.

When looking at the question number 1 from 2002, we can see that there are no significant differences between countries when asked about attitudes towards women working when they have no children. A clear majority thinks that women without children should work full-time. Questions two asked that should women work outside the home full-time, part-time or not at all when there is a child under school age. For this question, there is data for both 2002 and 2012. In 2002 there are some differences between the US, the UK, and the Nordic countries. In the US larger share of people think that women should stay home. Also in all countries, the majority think that those women should work either part-time or stay at home. In 2012 survey the attitudes have shifted. More people think that women with children under school age should work part-time, and in Finland, the attitudes have shifted so that more people think that those women should work either full-time or part-time, relative to the answers in 2002. The third questions asked whether women with the youngest child is still in school should work outside the home full-time, part-time or not at all. In 2002, there are little cross-country differences but overall compared to the previous question the attitudes shift more to the direction that majority think that those women should work part-time or either full-time. When comparing to answers from 2012 we can see that the trend in answers is still similar but in Finland, the majority of people think that those women should work full-time. The final question, whether women should work outside the home

full-time, part-time or not at all if the child has left the home, was only asked in the 2002 survey. The answer distribution is similar to the answers in the first question, the majority of the people think that those women should work full-time with Finland having the largest share. Still, the cross-country differences in attitudes are not that large.

There are differences between the answers from the Nordic countries and the US and the UK, the Nordic people have more open attitudes towards mothers with young children working either part-time or even full-time compared to staying home. Especially In Finland, the attitudes have shifted between 2002 and 2012 regarding mothers with young children, over 80 % think that those mothers should work at least part-time rather than staying at home. All in all, however, the graphical evidence from these graphs points towards the point that the Nordic countries are not strong outliers in terms of perceived gender equality in the labor market and the role of mother as the homemaker.

4 Data

In my thesis, I use two Finnish data registries, FLEED, and The Finnish medical birth register as my main source of data. FLEED[3], Finnish Longitudinal Employer-Employee Data, is a Statistics Finland's linked Individual-level data. FLEED contains background information on people from 1988-2015 in Finland for all the years during which the person has been alive, aged between 16 and 70 and residing in Finland. FLEED includes data on the person's basic characteristics such as age, education level, and place of living. Most importantly it includes a vast number of labor market data, such as annual labor earnings and employment status. The employer's enterprise code and the establishment code of the workplace are included in the data. The spouse identifier is also included, enabling me to link spouses together. My main outcome variable is annual labor earnings which include salaries from working. I also estimate child penalties in labor force participation and total annual income. In addition to labor earnings, the total income includes other benefits received such as maternity pay, pensions or unemployment benefits. The participation rate is calculated from a variable which indicates the main job market activity recorded at the last week of the year. I assign value 100 for those individuals who in the workforce and 0 otherwise. Wage rate and hours worked are reported on a yearly level by averaging monthly level data. Since not having

[3]The full description of the data can be found from `http://www.stat.fi/tup/mikroaineistot/kuvaus_henkilo.pdf`

any earnings is an important outcome for my analysis I will replace missing annual labor earnings and total income observations to have value zero, this is due to the fact that the Statistics Finland in many cases assigns a missing value to those observations with zero earnings.

The Finnish medical birth register provides information on children born in Finland between 1950-2013. I combine the birth register with the Finnish Longitudinal Employer-Employee Data (FLEED) using the individual identification codes. This will link the individuals whether they have had children on a specific year. My analysis is based on the event of first childbirths and studying the development of different outcome variables five years prior and ten years after the birth, hence I need the information on childbirths between 1993-2005. In addition to providing the year of birth of children the medical birth register also provides the month and date of birth of the first child. The month of birth enables me to do a separate analysis based on children born in January. Being able the specify the birth order of the child is crucial for my analysis, which I am able to identify from the birth register.

The analysis is based on administrative data for the population in Finland between 1988-2015. My main event study analysis is based on first child births where the parents are observed every year between 5 years before having a child and 10 years after. I am thus focusing on first childbirths where the parents are known, alive and reside in Finland throughout a 15-year window around the birth. More importantly, the identification codes enable me to link mothers, fathers, and children together. I will not impose any restriction on the relationship status of the individuals observed meaning that all individuals who have their first child between 1993-2005 are observed regardless whether they are married, cohabiting, separated, divorced, or have not yet formed a couple in any given year. I restrict my analysis to include all individuals above age 18 since underage births amount to a very small number of observations. My data is then formed of a core sample of 6,391,296 individual-year observations and 199,728 births.

Limitation of the FLEED data is that it does not include information on individuals hours worked or wage rate. To be able to estimate the impact of children on these margins, I use the Structure of Earnings data from Statistics Finland. However, the structure of earnings is gathered from 1995 to 2015, which means that to analyze the impact on hours worked and wage rates I will consider first childbirths between 2000 and 2005. There are also more inconsistencies in the individual-year data compared to the FLEED. Together these factors reduce the amount of individual-year observations from six million to 2,874,080 individual-year observations.

5 Descriptive statistics

This section shows descriptive statistics for those men and women observed in my main analysis, hence they are those who had their first child between 1993 - 2005 and are observed five years before and ten years after the birth of the first child. Tables 1 & 2 summarize the mean values of age, annual labor earnings, total income and participation rate for women and men in my sample by event time. Women's mean annual labor earnings five years before the birth of the first child are roughly 13,000 euros and the earnings have a growing trajectory up until the birth of the first child reaching roughly 19,000 euros. However, right after the birth of the first child, their earnings decrease for a few years after which they start to rise again. A similar trend can be seen in the total annual income but the decrease that occurs at the time of the birth is smaller. This can be due to the fact that total annual income includes labor earnings and other benefits received such as maternity pay. The mean annual labor earnings five years before the birth of the first child for men are higher compared to women, 16,500 euros. Similarly to women, men's earnings grow every year, but men do not face a drop in their earnings at the time of the birth of the first child. Instead, their earnings continue to grow year compared to the one before. Ten years after the birth of the first child the annual labor earnings of men are on average 41,000 euros whereas women have fallen clearly behind at 29,000 euros. Both men and women in the sample have a high participation rate, almost 99 %, during the period before the birth of the first child with no differences between the two groups. However, the participation for women declines after the birth and the participation rate doesn't recover even ten years after the birth only reaching 95 %. At the same time, the participation rate for men remains completely unaffected, staying at the same level for the whole 15 year time period. From the descriptive statistics, we can also see that women are on average one year younger than men at the time of the birth of the first child, mean age for women being 30 years old and men 31 years old.

Table 1: Women - mean values by event time

Women				
	(1)	(2)	(3)	(4)
Event time	Age	Annual labor earnings	Total annual income	Participation rate (%)
-5	25.3	13006	13683	98.4
-4	26.1	14427	15119	98.6
-3	26.9	15891	16583	98.8
-2	27.7	17321	17992	98.9
-1	28.6	18906	19523	98.2
0	29.8	13542	18880	81.2
1	30.7	11466	17734	73.5
2	31.5	16767	20144	77.3
3	32.5	17328	20806	82.2
4	33.5	19229	22027	84.4
5	34.4	21340	23568	88.2
6	35.3	23315	25177	90.5
7	36.3	24438	26324	91.7
8	37.3	25616	27504	93.1
9	38.3	27342	29067	94.3
10	39.2	28820	30529	95.3

Notes: The table shows mean values of age, earnings and participation rates for women in the main sample relative to event time where event time 0 is the year of birth of the first child

Table 2: Men - mean values by event time

Men				
	(1)	(2)	(3)	(4)
Event time	Age	Annual labor earnings	Total annual income	Participation rate (%)
-5	26.7	16500	17362	98.0
-4	27.5	18248	19082	98.2
-3	28.3	19850	20683	98.4
-2	29.1	21435	22232	98.6
-1	29.9	22992	23742	98.7
0	30.8	24079	25234	98.8
1	31.7	26030	27068	98.6
2	32.7	27967	28866	98.6
3	33.6	29916	30749	98.8
4	34.6	31737	32509	98.7
5	35.6	33655	34395	98.7
6	36.6	35411	36202	98.7
7	37.5	36951	37942	98.6
8	38.5	38463	39657	98.6
9	39.5	39861	41242	98.5
10	40.5	41283	42895	98.5

Notes: The table shows mean values of age, earnings and participation rates for men in the main sample relative to event time where event time 0 is the year of birth of the first child

To check the distribution of education level of individuals in my data I have summarized the shares for the highest educational degree acquired by an individual to table 3. The degrees range from basic education all the way to the highest possible, the doctoral degree. The table also includes proportions for the same degrees for the whole population in Finland in 2017 reported by the Statistics Finland.[4] We can see that the shares of the highest degrees in the data follow similarly the overall shares in Finland, with some exceptions such as higher share of higher-degree level tertiary degrees, lowest level tertiary education and upper secondary level degrees. 11.9 % of my sample only have basic education whereas in the total population the share of people with only basic education is 27.9 %

Table 3: Level of education in the main sample and in the total population (2017)

	(1)	(2)
Highest degree	Main sample	Total population (2017)
Upper Secondary Level	45.3 %	40.3%
Lowest Level Tertiary Education	19.6 %	9.4 %
Lower-Degree Level Tertiary Education	9.9 %	11.2 %
Higher-Degree Level Tertiary Education	12.2 %	9.3 %
Doctorate	0.9 %	1 %
Only basic education	11.9 %	27.9 %

Notes: Highest degree refers to the highest degree obtained by individual between time period 1988-2015. Total population refers to the whole population of Finland recorded by Statistics Finland in 2017

[4]Statistics Finland classifies the degrees as following. The upper secondary degree includes matriculation examination and vocational qualifications. Lowest level tertiary education includes degrees such as diploma in business and administration and a diploma in nursing which are not polytechnic degrees. Lower-degree level tertiary education comprises polytechnic degrees and lower university degrees, Higher-degree level tertiary education comprises education which leads to higher university degrees (master's degree) and specialist's degrees in medicine. Doctorate or equivalent level tertiary education are scientific licentiate and doctorate degrees.

6 Impacts of children

6.1 Event study methodology

I follow the approach used by Kleven et al. (2018) in their paper to study the impact that the arrival of children have on different labor market outcomes of women and men. I use an event study approach which is based on the possible changes in labor market outcomes around the birth of the first child for mothers relative to fathers. According to Kleven et al. (2018), although the decision of having children is not exogenous, the arrival of the first child creates steep changes in the labor market outcomes. Kleven et al. state that these changes are arguably independent to unobserved determinants of the labor market outcomes as they should evolve steadily over time. This approach has an additional advantage as it uses individual-level variation in the timing of first child, making it very precise. The identifying assumption of the event study method is similar to the one in the difference-in-differences framework; the timing of the event, childbirth, should be exogenous. What this means is that the birth of the first child is not determined by the dependent variable, for example, annual labor earnings. I use graphical evidence to support this claim, the labor market outcomes for both men and women should evolve similarly and unaffected by the arrival of children prior to the birth. In my analysis I include parents who are observed five years before and ten years after the birth of their first child between 1993 and 2005, meaning that my data set runs from 1988 to 2015. This event time is indexed by setting the year of the first child as event time 0 (t = 0) and event time running from t = -5 as five years before the birth to t = 10 as ten years after the birth of the first child. Hence there are a total of 16 event time's considered. Following the work of Kleven et al. (2018) I run the following regressions separately for both men and women:

$$Y_{ist}^{g} = \sum_{j \neq -1} \alpha_j^g * I[j = t] + \sum_k \beta_k^g * I[k = age] + \sum_y \gamma_y^g * I[y = s] + \upsilon_{ist}^g \quad (1)$$

Y_{ist}^{g} is the outcome variable of interest, e.g. annual labor earnings for gender g, individual i, in year s at event time t. The first term on the right-hand side includes

a full set of event time dummies, the second term includes a full set of age dummies and the third term includes a full set of year dummies. By omitting the event time -1, the event time coefficients α_j^g measure the impact of the arrival of the first child relative to the year before the birth. Year dummies control non-parametrically for trends that vary in relation to time such as wage inflation and business cycles, whereas the age dummies control non-parametrically for differences in life-cycles. For example, as shown by the descriptive statistics, women in my sample are on average younger than men at the time of the birth of the first child, making it important to control for age in the regression.

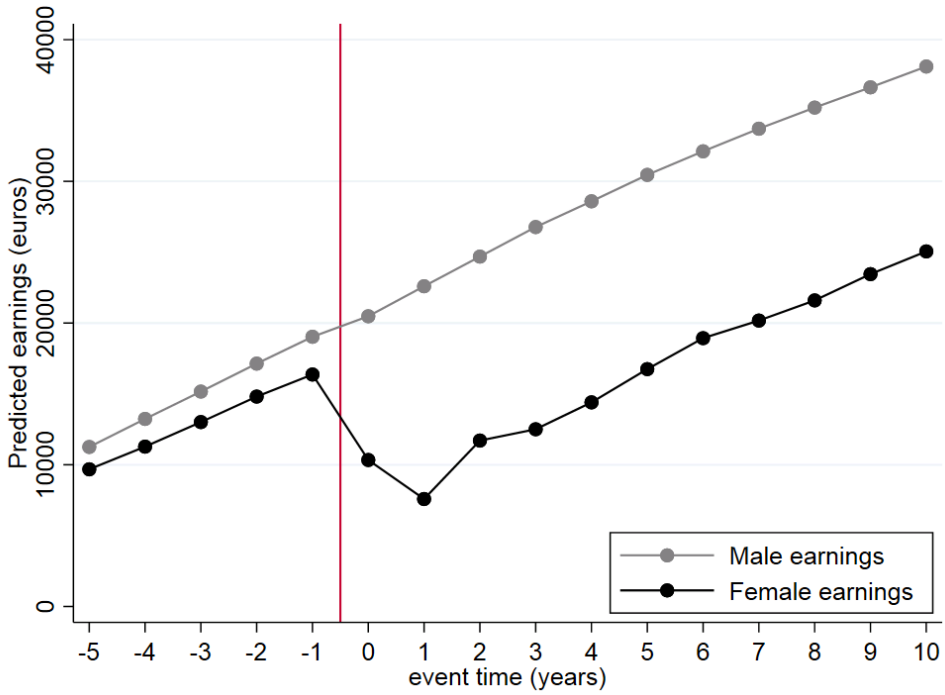


Figure 3: Earnings of men and women

Figure 3 plots the calculated average linear prediction coefficients from the regression (1) shown above with annual labor earnings as the dependent variable and event time, age and year dummies as the independent variables. Y-axis represents annual wage earnings and X-axis is the event time running from -5 to 10. From this figure we can see two things, firstly the earnings of men and women have a parallel trend before the birth of the first child. Secondly, after the birth, the earnings of men continue on the same trend but the earnings of women face a drop. Women's earnings start to recover two years after the birth but ten years after the birth the gap in earnings between men and women is significantly larger than before the birth.

The equation (1) is measured in levels. If I were to measure it in logs, I would not be able to keep the zero value observations in the analysis. To convert the estimated levels to percentages I use the same method as Kleven et al. (2018) and I first calculate the predicted outcome when omitting the contribution of the event dummies:

$$\hat{Y}^g_{ist} \equiv \sum_k \hat{\beta}^g_k * I[k = age] + \sum_y \hat{\gamma}^g_y * I[y = s] \tag{2}$$

Year-t effect of children as a percentage of the outcome absent the contribution of even time and therefore children, is then calculated from:

$$P^g_t \equiv \alpha^g_j / E[\hat{Y}^g_{ist}|t] \tag{3}$$

P^g_t is calculated for both women and men from event time -5 to 10. Summarizing the whole procedure, I first calculate the regression (1) for both men and women separately where the outcome variable is e.g. annual earnings with independent variables event time dummies, age dummies, and year dummies. The contribution of event time dummies is then deducted from the calculated linear prediction to get the predicted outcome when omitting the contribution of the event dummies, $\hat{Y}^g_{ist}$. The contribution of the arrival of the first child is then calculated by dividing the event time contribution by the $\hat{Y}^g_{ist}$. Child penalty on women relative to men is then defined as:

$$P_t \equiv \frac{\alpha^m_t - \alpha^w_t}{E[\hat{Y}^w_{ist}|t]} \tag{4}$$

where P_t is the percentage by which women are falling behind men due to children at event time t. I refer P_t in the next following sections as "child penalty".

6.2 Estimating impacts of children

Next, I present the results of the impacts of children on different labor market outcome variables for women and men using the previously defined framework. I study the impacts on annual labor earnings, participation rate, total annual income, wage rates and hours worked. The main analysis is based on the timeframe of five years before the birth of the first child and ten years after, but I will also show results when the timeframe is expanded to 20 years after the birth.

6.2.1 Estimating impacts of children on annual labor earnings

Figure 4 plots $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$ for both women and men. The outcome variable Y_{ist}^g is the annual labor earnings. Each observation measures the year t effect of children relative to the year before the birth of the first child (t = -1), hence event time -1 observations have a value of 0. Figures include a 95 percent confidence bands around the event time coefficients, and I use robust standard errors in all the figures.

As we can see from figure 4 the annual labor earnings of men and women evolve similarly before the birth of the first child. While annual labor earnings of women are lower compared to men starting at event time -5, women almost close the gap before the birth of the first child. However, after the birth of the first child, the earnings of men and women diverge. Women's earnings at the year of the birth, event time 0, are 46 % lower than the year before and one year after the birth the earnings are 65 % lower. At the same time, the earnings of men continue on a steady trend, with no apparent drop in earnings - graphical evidence shows men's earnings are almost completely unaffected by the arrival of the first child, with only 1.6 % decrease in earnings year after the birth compared to one year before. Ten years after the birth of the first child women's earnings have stabilized at around 21 % (P_{10}^w) below the earnings year before the birth of the first child , whereas the same number for men is 0.43 % (P_{10}^m) higher than a year before the birth of the first child.

Table 4 shows P_t^g calculated for both women and men by event time. The child penalty, P_t, is the percentage by which women are falling behind men due to children at event time t. The long-run child penalty at event time 10 (t = 10) is 21.03 %, meaning that the gap in earnings between men and women is 21 %.

Figure 4: Impact of children on annual labor earnings

Notes: The figure shows $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$ plotted for men and women separately. Child penalty refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$ which is the gap between men's and women's outcomes recorded at event time t

Table 4: Impact of children on annual labor earnings

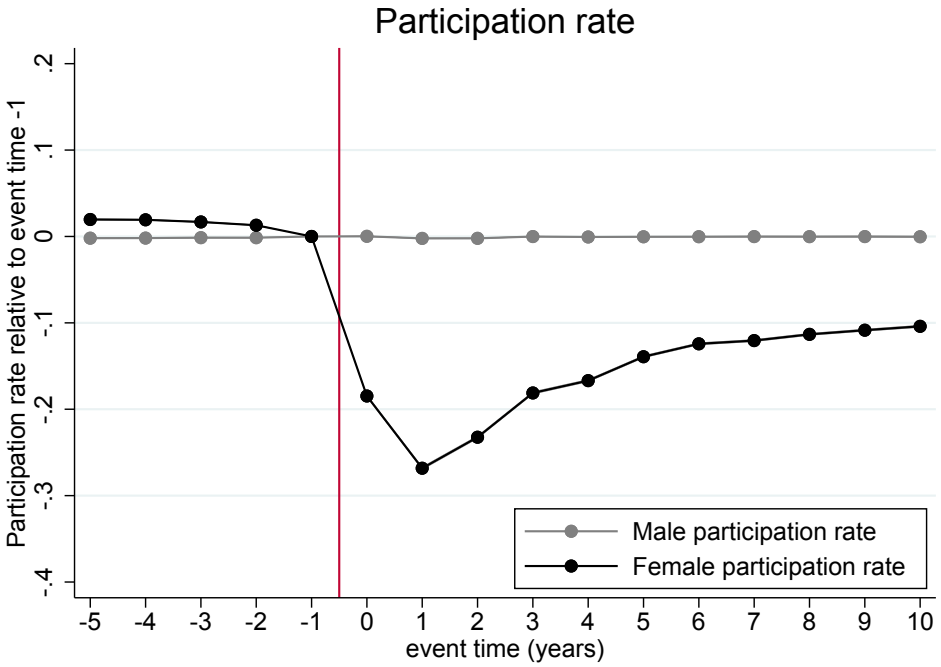
Event time	Women	Men	Child penalty
-5	-0.206	-0.117	0.043
-4	-0.143	-0.076	0.037
-3	-0.084	-0.046	0.022
-2	-0.029	-0.0174	0.006
-1	0	0	0
0	-0.462	-0.0165	0.413
1	-0.653	-0.008	0.614
2	-0.454	-0.004	0.433
3	-0.449	-0.0005	0.436
4	-0.397	-0.0003	0.385
5	-0.331	0.004	0.327
6	-0.280	0.003	0.276
7	-0.273	-0.0005	0.265
8	-0.258	-0.001	0.251
9	-0.229	0.0004	0.224
10	-0.209	0.004	0.210

Notes: "Women" and "Men" refers to $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^w | t]$. "Child penalty" refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

6.2.2 Estimating impacts of children on participation rate

Figure 5 plots $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$ for both women and men. The outcome variable Y_{ist}^g is participation rate. The variable is defined as such that being outside of the workforce is indicated by value 0 and value 100 otherwise, meaning that the individual is either working or unemployed searching for a job. Each observation measures the year t effect of children relative to the year before the birth of the first child (t = -1), hence event time -1 observations have a value of 0. Figures include a 95 % confidence intervals around the event time coefficients based on robust standard errors.

Figure 5: Impact of children on participation rate



Notes: See the notes to Figure 4

From figure 5 we can see that the participation rate for both women and men evolve parallel before the birth of the first child, women even have higher participation rate than men, but right after the birth, the probability for women to participate in the workforce plunges and during the 10 year period after the birth never converges with men. After the birth, the probability for women to participate in the workforce relative year before the birth is 18,5 % lower and one year after the birth

at event time 1 the number is 27 %. The child penalty ten years after the birth is roughly 10 %, meaning that women are 10 % less likely to participate in the workforce compared to men due to the birth of the first child. Men are almost completely unaffected by the event. Table 5 summarizes the average coefficients for men and women and the child penalty plotted in the figure.

Table 5: Impact of children on participation rate

Event time	Women	Men	Child penalty
-5	0.012	-0.002	-0.022
-4	0.019	-0.002	-0.021
-3	0.017	-0.001	-0.018
-2	0.013	-0.001	-0.014
-1	0	0	0
0	-0.185	0.0002	0.185
1	-0.268	-0.002	0.266
2	-0.232	-0.002	0.230
3	-0.181	-0.0001	0.181
4	-0.167	-0.0006	0.166
5	-0.139	-0.0003	0.139
6	-0.124	-0.0003	0.124
7	-0.121	-0.0002	0.120
8	-0.113	-0.0002	0.113
9	-0.108	-0.0001	0.108
10	-0.104	-0.0003	0.104

Notes: See the notes to Table 4

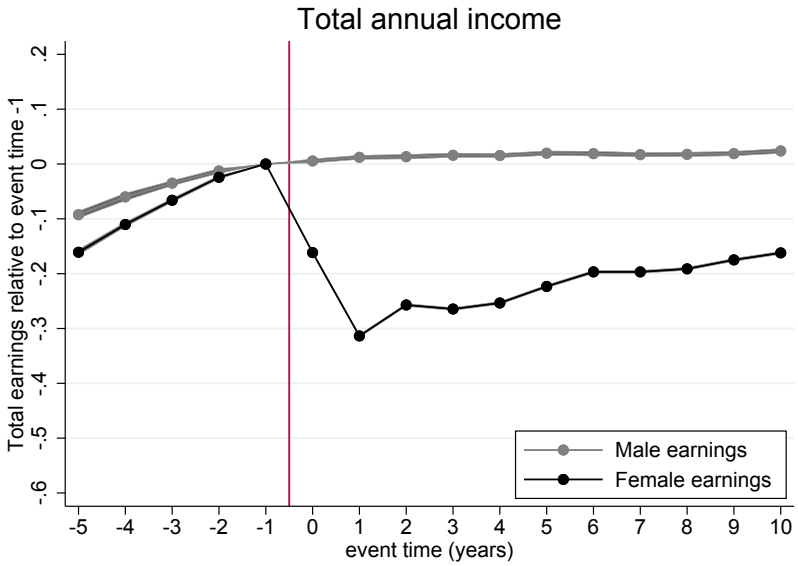
6.2.3 Estimating impacts of children on total annual income

My main variable for earnings is the annual labor earnings, earnings from working before taxes, which is similar to the one that Kleven et al. (2018) use in their study [5]. Since my data allows it, I will also do the same analysis as before but with the variable total annual income. In addition to salaries from working it also includes benefits received such as maternity pay. Using the same specification as before, figure 6 plots $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$ for both women and men.

[5] Kleven et al. (2018) use gross labor earnings, excluding taxes or transfers.

The pre-trend is similar to figure 4 with annual labor earnings, with the total annual income for men and women evolving similarly without a significant gap between them. As it was with the labor earnings, the total income of men remain unaffected at the time of the birth and remains fairly stable throughout the whole time period. However, women's total income drops at the time of the birth, starts to recover two years after the birth but never reach the earnings of men or the pre-birth level. When comparing the results from figure 6 to figure 4, the one with annual labor earnings, we can see that the drop in earnings that women face after the birth is more moderate. Maternity pay and other benefits received by mothers at the time and following the birth can explain why the drop in earnings is not as large. The long-run child penalty after ten years is 17 %. Table 6 summarizes the average coefficients for men and women and the child penalty plotted in the figure.

Figure 6: Impact of children on total annual income



Notes: See the notes to Figure 4

Table 6: Impact of children on total annual income

Event time	Women	Men	Child penalty
-5	-0.141	-0.089	0.026
-4	-0.096	-0.057	0.023
-3	-0.057	-0.033	0.015
-2	-0.020	-0.012	0.004
-1	0	0	0
0	-0.161	0.004	0.157
1	-0.312	0.012	0.312
2	-0.258	0.011	0.262
3	-0.260	0.012	0.266
4	-0.246	0.009	0.251
5	-0.218	0.011	0.226
6	-0.194	0.009	0.200
7	-0.194	0.006	0.197
8	-0.189	0.005	0.191
9	-0.173	0.006	0.176
10	-0.161	0.009	0.169

Notes: See the notes to Table 4

6.2.4 Estimating impacts of children on hours worked & wage rates

Thus far I have shown the impact of children on three variables, annual labor earnings, total income and participation rate. Following Kleven et al. (2018) next I study the impact of the arrival of children on wage rates and hours worked. However, the FLEED data does not contain information on individual's hours worked or wage rate. To get this information I use Statistics Finland's structure of earnings database and combine it with the birth register and FLEED. However, the structure of earnings database is gathered from 1995 to 2015, which means that for this analysis I will consider first childbirths between 2000 and 2005. The structure of earnings does not have as large coverage of individuals in Finland compared to FLEED database, effectively reducing the size of the sample observed. Together these factors reduce the sample size to 2,874,080 individual-year observations compared to the roughly six million observations in the main analysis.

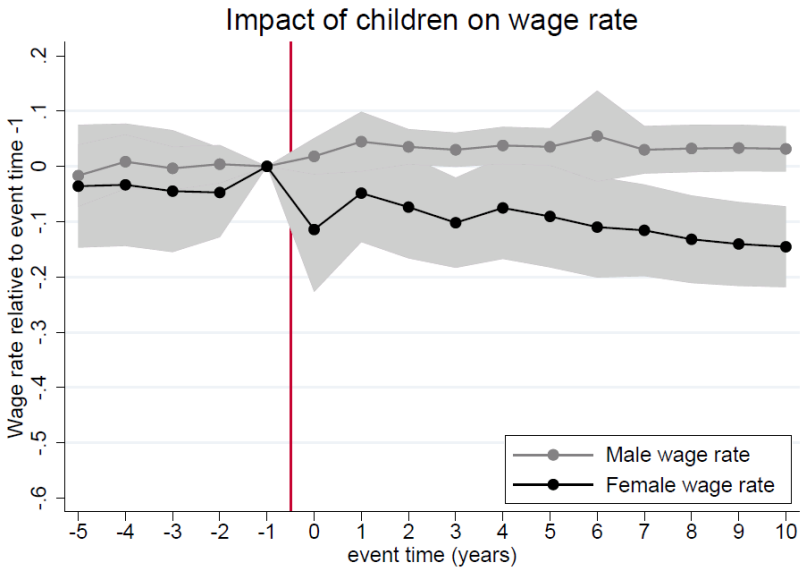
Figure 7 shows the event study analysis with monthly hours worked as the outcome variable. During the five year period before the birth of the first child, the monthly

hours for men and women are pretty much the same, but the hours worked by women drop at event time 1 and remains below the hours worked by men for the rest of the observation period. Figure 8 shows the same analysis with the hourly wage rate as the outcome variable. We can again see a decline in wage rates for women after the birth while men are unaffected. In this case, the confidence intervals are larger than in the previous figures taking away the accuracy of the estimate but still giving evidence that women's wage rates are negatively affected by the arrival of the children. Point estimates shown in the figures are reported in tables A1 & A2 in the appendices. I also repeated the event study analysis with the annual labor earnings, total annual income and participation rate for this sample of parents to see are there differences between the results. Figures A7-A9 in the appendices show that the impact of children on these margins are almost identical when compared to the larger sample used before.

Figure 7: Impact of children on hours worked

Notes: See the notes to Figure 4

Figure 8: Impact of children on wage rate



Notes: See the notes to Figure 4

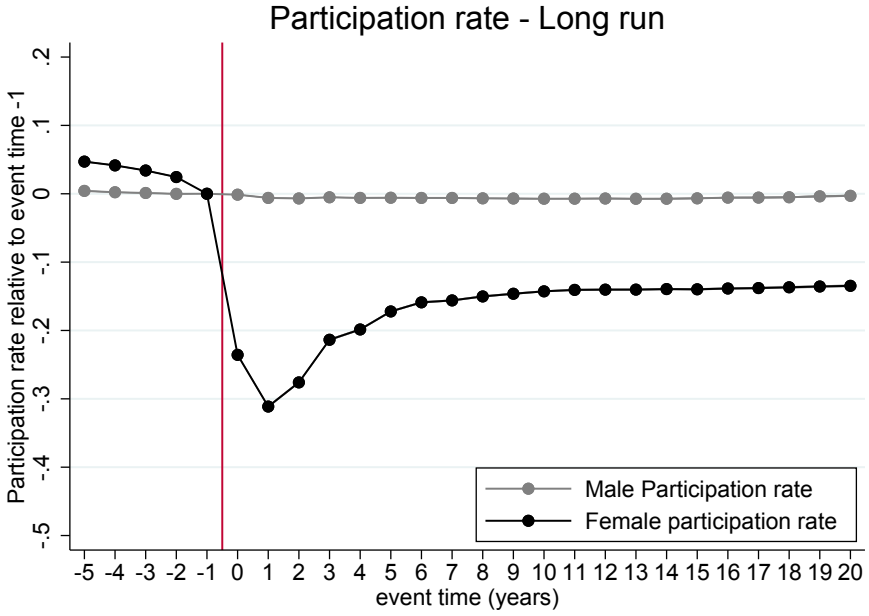
6.2.5 Estimating impacts of children in the long run

My main analysis shows the impact of children over a 10-year horizon after the birth, but since my data allows me to expand the timeframe to up to 20 after the birth of the first child I now present the results for a longer time period. I expand my data from a balanced panel of parents who had their first child between 1993-2005 and are observed every year between five years before and ten after the year of their first child to an unbalanced panel of parents who had their child between 1993-2005 and observed five years before and up to 20 years after the birth of their first child. Figures 9-11 show the average coefficients for long timeframe impacts. The main takeaway from all three of the figures is how persistent the child penalties of children are. The annual wage earnings, total annual income and participation rate for women remains almost the same between years 10 and 20, showing that there is no convergence of trends between men and women even during this longer time period. Point estimates shown in the figures are reported in tables A3 - A5 in the appendices.

Figure 9: Impact of children on annual labor earnings - long run

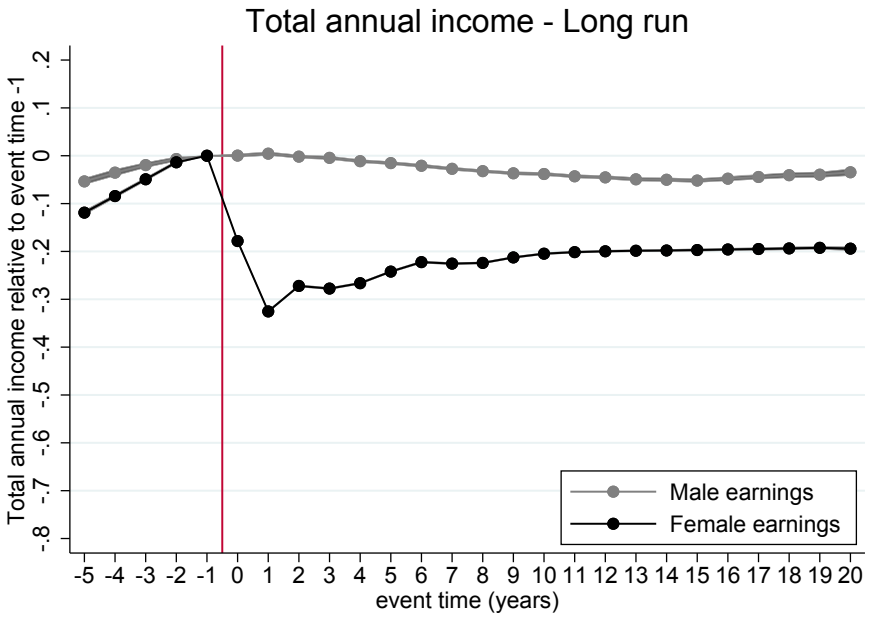
Notes: See the notes to Figure 4

Figure 10: Impact of children on participation rate - long run



Notes: See the notes to Figure 4

Figure 11: Impact of children on total annual income - long run



Notes: See the notes to Figure 4

6.2.6 Estimating impacts of children - January births

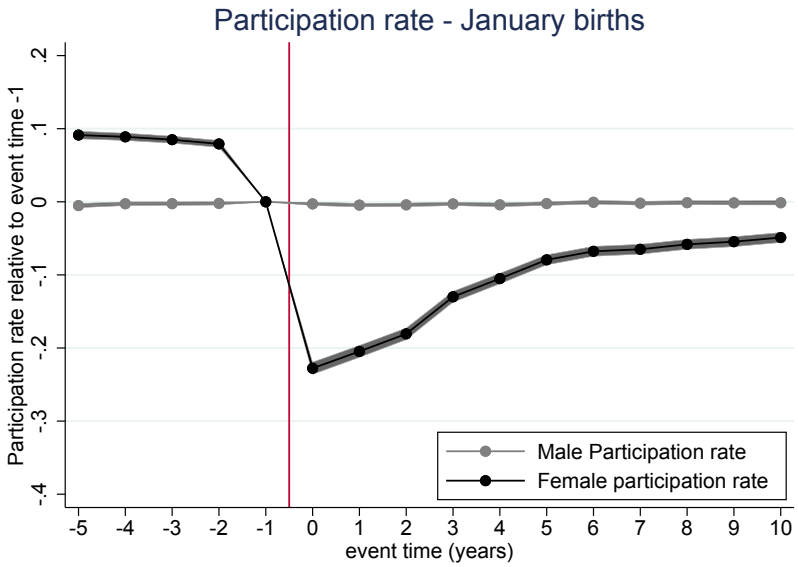
In all the figures shown before we can see that the drop in earnings and participation rate for women in year 0 is not much larger than the drop in the following years, which could raise questions due to the time taken off from work due to maternity leave right after the birth of the child. The use of calendar-year measures of annual wage earnings, total earnings and participation rate could create attenuation bias. As women have the child sometime during year 0 it means that for example the portion of the earnings in that year was realized before the childbirth. To check this aspect, I restrict my sample to parents who had their childbirth in January to have calendar time and event time coincide. This reduces the sample significantly, resulting in larger confidence intervals. From figures 12-14, we can see a more pronounced dip in event year 0 as one would expect. This drop shows the additional time out of the job market for mothers after the childbirth. Secondly these figures show a slight drop in wage earnings and total earnings but an even larger drop in participation rate just before birth in event time -1, year before the birth, which could be explained by mother's leaving their jobs prior to the birth for sick or maternity leave to which they are entitled to. Finally and most importantly there seem to be no significant differences in long run child penalties

ten years after the birth compared to figures 4-6, child penalties are still persistent and women have fallen behind men in all three outcome variables. Point estimates shown in the figures are reported in tables A6- A8 in the appendices.

Figure 12: Impact of children on annual labor earnings - January births

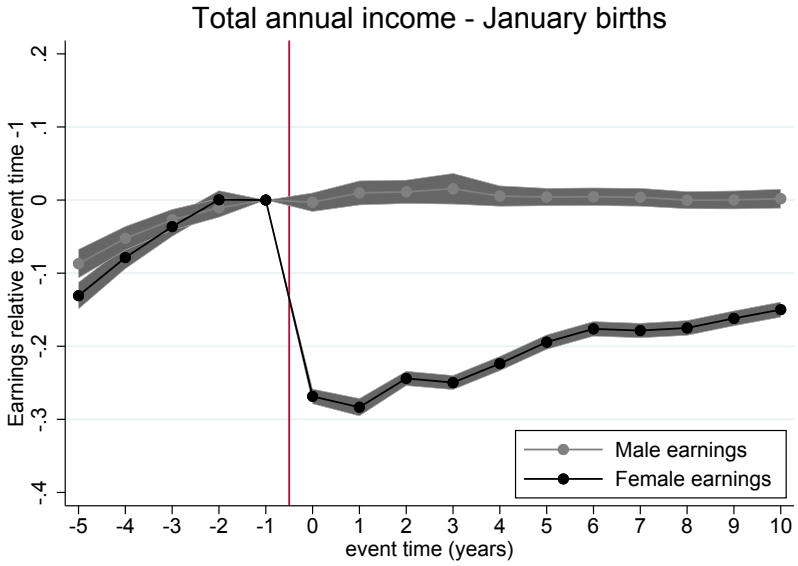
Notes: See the notes to Figure 4

Figure 13: Impact of children on participation rate - January births



Notes: See the notes to Figure 4

Figure 14: Impact of children on total annual income - January births



Notes: See the notes to Figure 4

6.2.7 Estimating impacts of children - total completed fertility

The main analysis of the impact of children on the parents' earnings focuses on the whole population of individuals regardless of how many children they end up having. This means that in addition to the arrival of the first child, the estimates include the effect for the possible following children born in the 10 year time period after the birth of the first child. Table 7 shows the proportions of maximum children the individuals in my sample end up having up until the year 2015. Roughly 50 % of parents end up with having two children and 80 % have more than one child.

Maximum number of children	proportion
1	19.2 %
2	50.4 %
3	23.3 %
4	7.15 %

Table 7: Proportions of total completed fertility in the main sample

Next I estimate the effect of children on annual labor earnings for different subsamples based on the maximum children the individuals end up having during the timeframe of 1988-2015. I divide the parents to four subgroups, those with total fertility of 1,2,3 and 4 children [6]. Figure 15 replicates the same event study estimates as before for annual labor earnings for the four groups five years before and ten years after the birth of the first child. The figures include the same 95 % confidence bands, the bands are somewhat larger due to the smaller sample sizes.

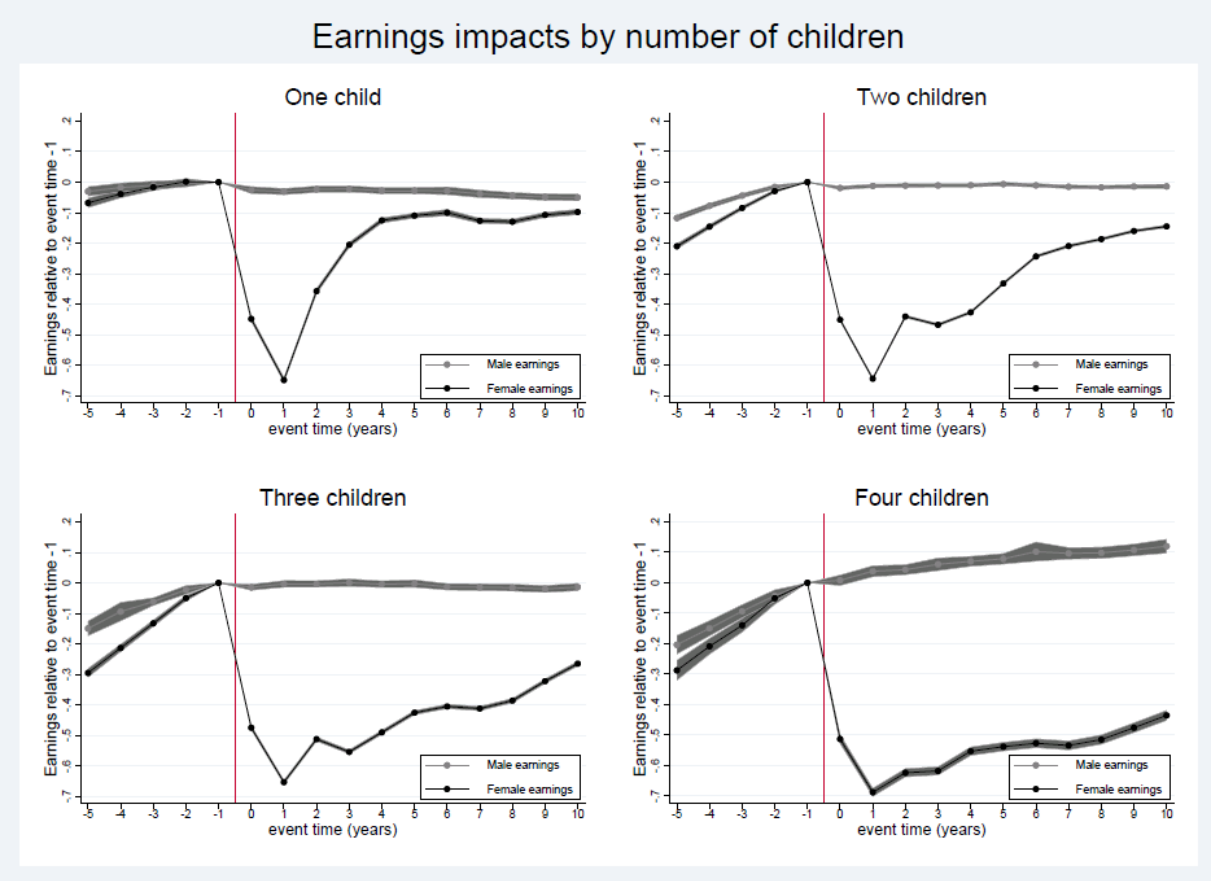
The initial drop in earnings in the first years after the birth for all four groups is very similar, the arrival of children causes sharp and large drops in the earnings of women. Meanwhile, the earnings of men are almost unaffected. There is a slight declining trend in earnings over time for the men with only one child and a moderate upwards trend for men with four children over time but overall the trends for men in all subgroups are fairly similar and men do not face a significant drop right after the birth of the first child. When looking at the evolution of earnings for women for the four subgroups we can see that while the initial drop

[6]The total fertility is defined as the total number of children for the individuals considered in my sample calculated at the year 2015. The estimates for "four children" includes individuals with 4 or more children.

is similar in magnitude for all groups, the women with only one child recover from the drop faster and at the event time 10, ten years after the birth, their earnings have stabilized only slightly below the earnings of men. The key takeaway here is that the earnings gap between men and women increases with the total number of children they end up having, women with four or more children face the largest gap in earnings. Also when looking at the figure for parents with two children, it is fairly similar to figure 4, which plots the impact of children on annual labor earnings for the whole population, which would seem logical since the average completed fertility in Finland is roughly two according to Statistics Finland (2018). Also since these two children families make up 50 % of the sample, it is logical that the results are driven by this specific subgroup. All in all, I can confirm that regardless of the total number of children the parents end up having, the initial impact of children is substantial and persistent even after ten years.

A possible explanation for this trend according to Kleven et al. (2018) could be that in larger families the parents anticipate to have more children after the first child and hence mothers would be more likely to take more responsibility at home right after the birth of the first child in anticipation for more children to come. It could also be that the families reach their maximum size in a relatively short period of time making it more likely that these mothers are out of the workforce, work part-time or shorter hours for longer consecutive periods of time compared to those mothers who have only one child.

Figure 15: Impact of children on annual labor earnings - 1-4 children



Notes: See the notes to Figure 5

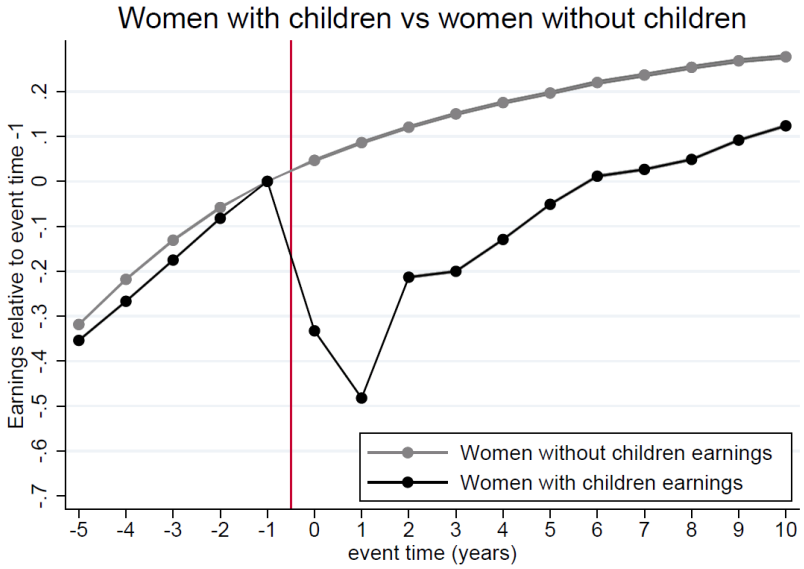
7 Evolution of earnings with and without children

According to Kleven et al. (2018), the identification of short-run effects in an event study design is based on smoothness, the outcomes for both men and women evolve similarly in the pre-birth period, and is hence quite compelling but at the same time, the identification of longer-term effects requires stronger assumptions. When moving further from the event of birth, the parallel trends observed in the pre-birth period after controlling for age and year, lifecycle and time trends, become less informative. Next, I follow Kleven et al. (2018) and present an identification

check in a form of difference-in-differences event study design. In this design, I compare annual labor earnings of those women and men who had children to those women and men who did not have children during the 1988-2015 time period. I expand my original data set which consists of a balanced panel of parents who had their first child between 1993-2005 to a data set which in addition to those parents also includes those men and women who are observed throughout the whole time period and did not have children. For the event study method to work, I need to assign placebo births to those men and women who did not have children. I use the mean age at the time of birth for men and women in my main sample to assign these placebo births. In the regression, I control for year fixed effects.

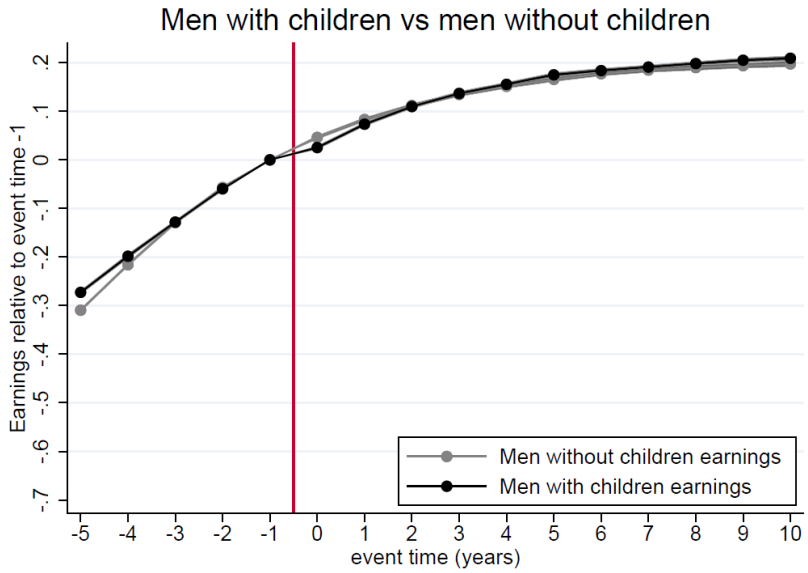
Figure 16 shows the difference-in-differences event study design for women and figure 17 the same design for men. Both figures include 95 % confidence intervals. Graphically we can confirm that the parallel trends assumption is satisfied, the pre-trend for both men and women is almost identical. From figure 17, we can see that both groups of men have almost identical evolution in earnings. Figure 17 shows that there is a small drop in earnings for men with children after the birth compared to the control group, roughly 2 %, meaning that men are also affected by the arrival of the first child. Although, after ten years there is virtually no difference between the two groups. But when we look at figure 16, we can clearly see that children have an impact on women. Although the earnings pre-trend for women with children and for those without children is fairly similar, women with children earn roughly 5 % less than the control group, the arrival of the first child cause a major drop in women's earnings compared to the control group which continues its upward trajectory. After ten years the gap is still persistent - women with children have fallen behind those women without children by almost 12 %. The following table 8 shows child penalties for men with children compared to men without children and women with children compared to women without children by event time. Figures A10 & A11 in the appendices show the difference-in-differences event study with participation rate as the outcome variable. These figures show the same impact as before, men with children and men and women without children have a similar trend in participation rate, they are unaffected by the arrival of the first child while women with children experience a drop after the birth and remain behind women without children in participation rate even ten years after the birth. These results give confirmation for my baseline results reported in the previous section. It is also striking that these results are almost identical to those from the study by Kleven et al. (2018) in Denmark. This robustness check suggests that the impacts of children could be causally identified based on within-person variation, as also was argued by Kleven et al. (2018) in their study.

Figure 16: Earnings impact of children in a difference-in-differences event study design - women



Notes: See the notes to Figure 4

Figure 17: Earnings impact of children in a difference-in-differences event study design - men



Notes: See the notes to Figure 4

Table 8: Difference-in-differences - Child penalties

Event time	Child penalty - Women	Child penalty - Men
-5	0.052	-0.053
-4	0.063	-0.023
-3	0.051	-0.001
-2	0.023	0.003
-1	0	0
0	0.362	0.020
1	0.523	0.009
2	0.298	0.002
3	0.305	-0.002
4	0.260	-0.004
5	0.207	-0.008
6	0.171	-0.005
7	0.170	-0.005
8	0.163	-0.007
9	0.139	-0.010
10	0.120	-0.001

Notes: "Child penalty - Women" and "Child penalty - Men" are the percentages by which women or men with children fall behind women or men without children. More specifically $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

7.1 The cost of the arrival of children

Previously I have shown that the arrival of the first child creates a sharp drop in women's earnings relative to the year before the birth while men are almost completely unaffected. My results show the effect is persistent during the ten year observation period after the birth. Since women fall behind men in relative earnings every year after the birth, in this section I show what is the cumulative effect of children on earnings measured in euros. To have a suitable counterfactual effect to estimate the magnitude of this cumulative earnings gap I expand my original data set which contains a balanced panel of parents who had their first child between 1993-2005 to a data set which in addition to those parents also includes those men and women who are observed throughout the whole time period and did not have children. For the event study method to work, I need to assign placebo births to those men and women who did not have children. I am using the mean age at the time of birth for men and women in my main sample to assign these placebo births. The earnings gap is calculated by adding the annual labor

earnings differences between men and women each year starting from five years before the birth of the child, event time -5.

Table 9 shows that the cumulative annual labor earnings gaps before event time -1 for those men and women with and without children are very similar with little differences. However, after the birth of the first child, the gap increases significantly between men and women who had a child. At the same time, the cumulative gap for those men and women without children also continues to increase but the increase over time is much more moderate without any significant spikes in the trend.

Table 9: Cumulative annual labor earnings gaps

Event time	Cumulative labor earnings gap - With children	Cumulative labor earnings gap - Without children
-5	1577	1919
-4	3534	3815
-3	5683	5801
-2	8008	7844
-1	10671	9917
0	20812	12025
1	35824	14122
2	48805	16143
3	63073	18062
4	77263	19838
5	90968	21499
6	104152	22965
7	117690	24283
8	131295	25400
9	144472	26344
10	157519	27205

Notes: Table 9 shows the cumulative gap in annual labor earnings between men and women with and without children starting from five years before the birth of the first child.

At event time -1, one year before the birth of the first child, the cumulative gap for those men and women with children is on average 10671 euros whereas the same gap for those without children is 9917 euros. One year after the birth the cumulative gap for men and women with children has increased to 35824 euros and ten years after the birth the cumulative gap is 157519 euros. At the same time, the cumulative labor earnings gap for men and women without children is 14122

euros at event time 1 and 27205 euros at event time 10. Using men and women without children as a counterfactual earnings gap, proxying for how the earnings gap would have evolved without the arrival of children, the differences between these two gaps at event time 10 is roughly 130000 euros. This could be interpreted that the cost of the arrival of the first child for a Finnish mother is 130000 euros ten years after the birth. It should be noted that those women and men who choose not to have children can be inherently different from those women and men who have children, but this comparison gives some magnitude on the opportunity cost of children for mothers.

8 Comparing the results between Finland and Denmark

Since I follow fairly accurately the approach of Kleven et al. (2018), it is interesting to see what are the similarities and differences in the impacts of children between Finland and Denmark. In Finland, the initial drop in annual labor earnings after the birth is significantly larger. One year after the birth the earnings of mothers are almost 70 % less compared to the year before birth whereas in Denmark the drop in earnings is roughly 30 %. After ten years the wage gap between mothers and fathers is very similar in both countries, close to 20 %. Similarly, the drop in the participation rate for mothers in Finland is one-tenth larger after one year but after ten years the gaps are similar, 10 % in Finland and 13 % in Denmark. The impact on hours worked is much more moderate in Finland compared to Denmark and after then years the gap in Finland is 4 % and 7 % in Denmark. The long-run gap in wage rates is similar in both countries, but the confidence bands for wage rates in Finland is much larger due to the smaller sample size used for these estimates. When looking at the results in the very long run, 20 years after the birth of the first child, the child penalties are fairly similar in magnitude in both countries, 16.8 % in annual labor earnings and 13.2 % in participation rate in Finland , 20 % and 13.4 % respectively in Denmark. The effect by the total number of children on the wage gap follows the same trend in both countries, increasing the total number of children increases the wage gap for women compared to men. When restricting the data set to January births, the more pronounced dip in event year 0 is seen in both countries, but the gap after ten years is smaller in Finland than in Denmark. Finally, when comparing the annual labor earnings of men and women with and without children, the figures are again almost identical in Finland and Denmark.

However, the earnings gap between women in Finland after ten years is smaller in Finland compared to Denmark, 12 % in Finland and 20 % in Denmark.

Kleven et al. (2019) in their study expanded the event study analysis from Denmark to study the child penalties in earnings also Sweden, Germany, Austria, United Kingdom, and the United States. In table 10 is reported the child penalties ten years, event time 10, after the birth of the first child in these countries and Finland. Kleven et al (2019) results show that the earnings of women drop significantly in all of the countries after the arrival of the first child and there remains an earnings gap between men and women in all of these countries ten years after the birth. The child penalties in the Nordic countries are fairly similar and lowest out of the seven countries with women in Germany and Austria facing the largest earnings gap, between 50-60 %. As an explanation why the child penalties are highest in the German-speaking countries, Kleven et al. (2019) suggest that these countries have more conservative views compared to the Nordic countries towards gender roles and the father is more likely to be the breadwinner while mothers take care of the children. While the three Nordic countries are similar in the long run child penalty magnitude, Finland and Sweden have much larger short term child penalties just after the birth. These differences could be explained by differences in family policies, more generous policies could encourage mothers to stay longer out of the workforce after the birth. Kleven et al (2019) state that Sweden has more generous and longer parental leave and benefits scheme compared to Denmark. As Finland also has generous parental leave and home care allowance, it would make sense that Finland and Sweden have larger short term child penalties compared to Denmark.

The results of this comparison and the similarities in the magnitude of the results give some external validity to both this empirical approach and the impact of children on their parents. All in all, both in Finland and Denmark, while women face a drop in all outcome variables measured the men are almost totally unaffected or only slightly affected by the arrival of the first child.

Table 10: Child penalties in annual labor earnings across countries

	FIN	DEN	SWE	GER	AUS	UK	US
Child penalty in labor earnings at event time 10	21 %	21%	27 %	61 %	51%	44 %	31 %

Notes: Table 10 shows the child penalties in annual labor earnings excluding taxes and transfers in Finland, Denmark, Sweden, Germany, Austria, United Kingdom and United States at event time 10, ten years after the birth of the first child. Results for countries other than Finland are from Kleven et al. (2019) study "Child penalties across countries: evidence and explanations". "Child penalty" refers to $P_{10} \equiv \frac{\alpha_{10}^m - \alpha_{10}^w}{E[\hat{Y}_{is10}^w|10]}$

9 Conclusions

The objective of my thesis is to study whether the arrival of children has an impact on the gender wage gap in Finland. Based on the results the impact is negative, large and persistent. Using the full population of Finland and an event study method I show that the arrival of children creates a sharp and persistent drop for women in all labor market outcomes studied while men are almost completely unaffected. Up to five years before the birth of the first child there is little difference in labor market outcomes of men and women, but one year after the birth women's annual labor earnings drop by 61 %, total annual income by 30 % and participation rate by 26 %. After ten and even twenty years, the effect of children is still persistent with child penalty in earnings imposed on women being roughly 20 %. The striking fact is that women fall behind men in earnings and other outcome variables every year after the birth. Thanks to the large size of the data on an individual level, the results are very accurate. When adding up the labor earnings differences between men and women every year and comparing this cumulative wage gap to the gender gap of those individuals who did not have children, the cost of the arrival of the first child for a Finnish mother is 130000 euros ten years after the birth of the first child. Overall, the results are particularly important if we take into account the fact that Finland has a generous welfare system for mothers and Finland is characterized as an egalitarian country for all people regardless of gender. One would think that Finland was one of the last countries to find such large gender gaps. The results suggest that the gender gap today in earnings could be more accurately addressed as a penalty on motherhood for the fact that children drive a large portion of the gap.

This is the first paper in Finland to study the impact of the arrival of children on the wage gap. The main advantage of my thesis is the vast data available in Finland, rather than using surveys or smaller and more specific samples. The labor market outcomes are measured precisely with the whole population for a long period of time. In addition to showing the effect of the intensive margin, the impact of the first child, I show that the extensive margin, the effect of a total number of children, increases with the number of children. In all cases, a child has a negative impact on the labor market outcomes of the mother but mothers with more children face the biggest adverse impact. The similarity in results and magnitudes from Denmark and Finland give these results external validity, this effect of children is not only Finland specific.

While the main purpose and of my thesis is to study the impact of children rather than provide direct policy recommendations, these results support some welfare and policy interpretations. Finland's generous maternity leave and home care allowance could be one of the reasons for the large earnings gap especially in the short term, as the system encourages women to stay out of the labor force for longer periods of time. Mothers take the bigger share of childcare responsibilities after the birth which coincidentally takes a toll on their labor market outcomes compared to the fathers. As reviewed in section 3 the Finnish child care system places more emphasis on the mother rather than the father when looking at the available leave days before and after the birth of the child. While maternity leave and childcare allowance enable women to stay home and take care of their child without fear of losing their job, this leave also creates a potential gap in mothers work experience which could set back their career path. A possible solution to the wage gap created by the event of having children could be to get fathers more involved in the child care, hence sharing more equally the negative labor market impacts of children between the parents. This could be achieved by increasing the available days for paternity leave or increasing the leave days for both or either of the parents to use instead of focusing on maternity leave. The obvious problem with increasing the available leave days for fathers could be that they would not respond to this and mothers would still take the majority of the childcare responsibilities. Increasing the degree of workplace flexibility and the possibility of remote work for mothers could also have a positive impact on mothers labor market outcomes after the birth. After the maternity leave ends, parents can choose to take care of their children at home thanks to the home care allowance, HCA. According to Kosonen (2014), this HCA system creates incentives especially for mothers to stay at home, reducing labor supply incentives. In addition, this system in Finland is very generous even when compared to other Nordic countries, and Kosonen (2014) states that the Finnish HCA incentives are on such a high level that even the high-income parents are incentivized to stay home for longer

time periods. This gives some evidence to why the child penalties continue to be so persistent even 10 years after the birth. Kosonen (2014) shows that Finnish mothers reduce their labor supply due to the financial incentives created by HCA, but at the same time, fathers who are also eligible for the HCA don't respond to it. Future research should focus more on the possible policy implications.

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A Appendices

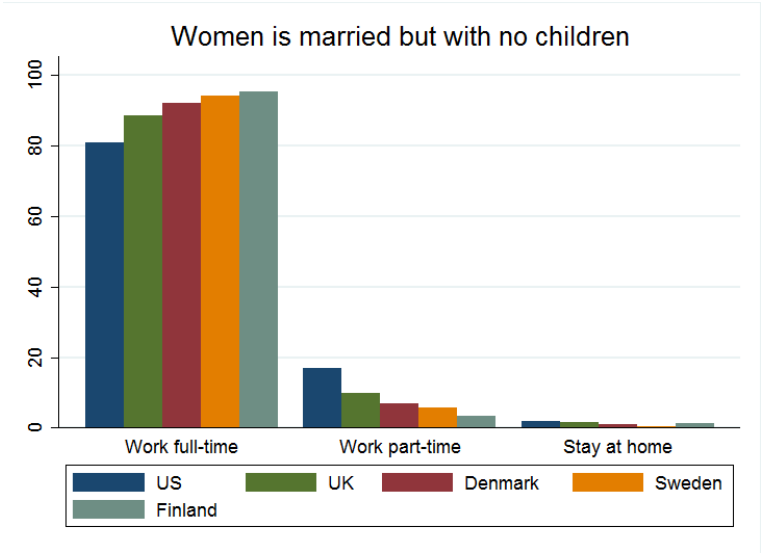

Figure A1: 2002: Do you think that women should work outside the home full-time, part-time or not at all when they are married but with no children?

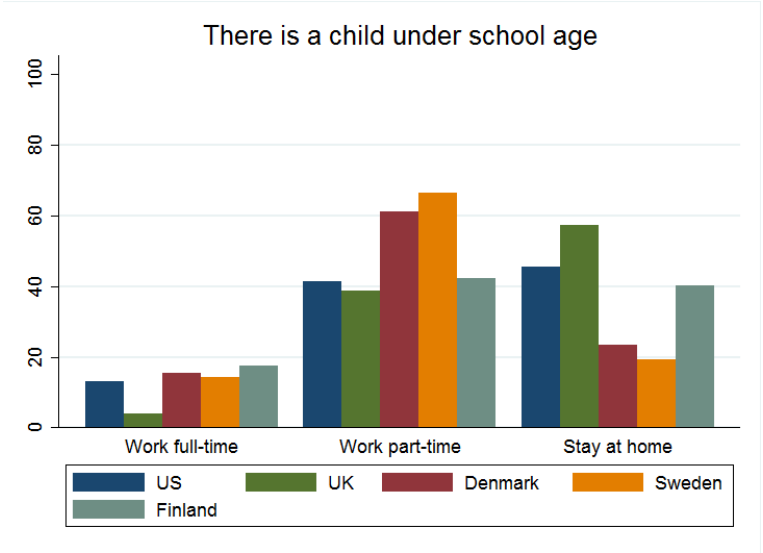

Figure A2: 2002: Do you think that women should work outside the home full-time, part-time or not at all when there is a child under school age?

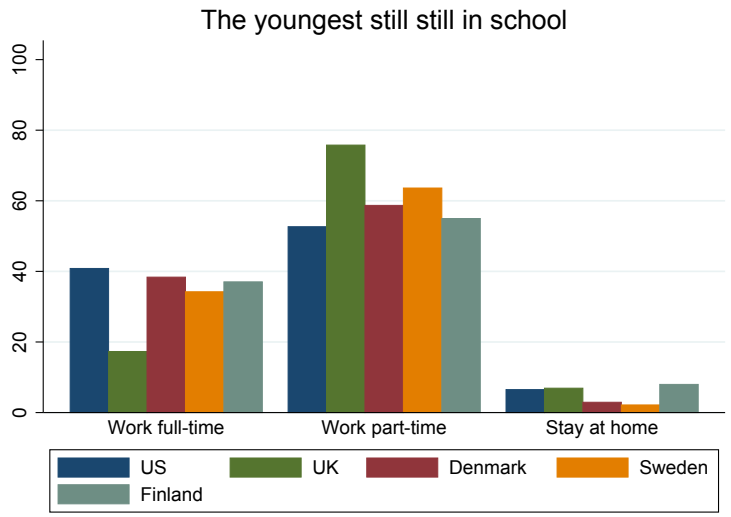

Figure A3: 2002: Do you think that women should work outside the home full-time, part-time or not at all when the youngest child is still in school?

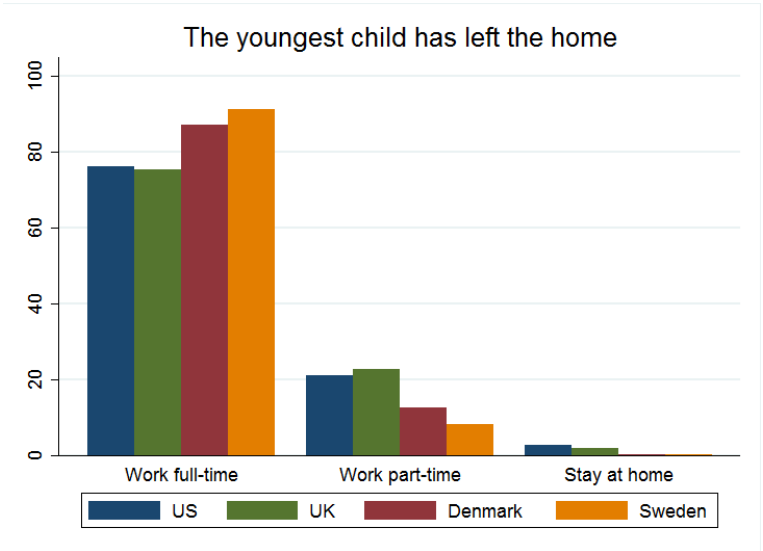

Figure A4: 2002: Do you think that women should work outside the home full-time,part-time or not at all if the child has left the home?

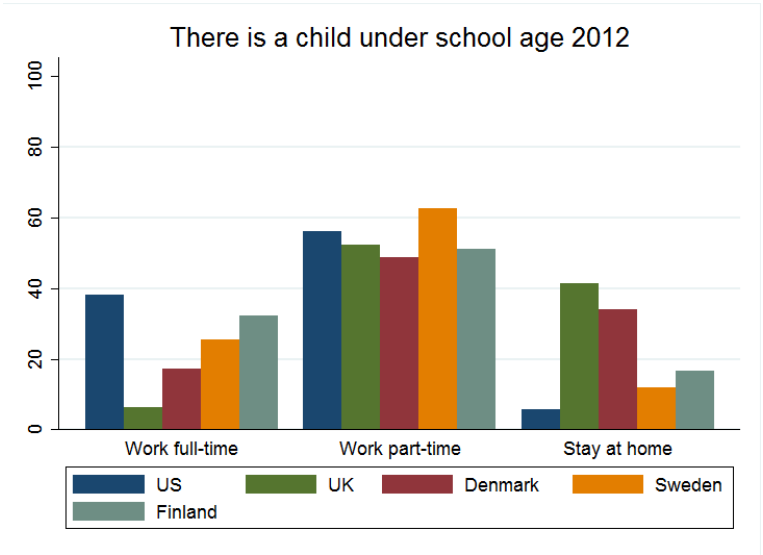

Figure A5: 2012: Do you think that women should work outside the home full-time, part-time or not at all when there is a child under school age?

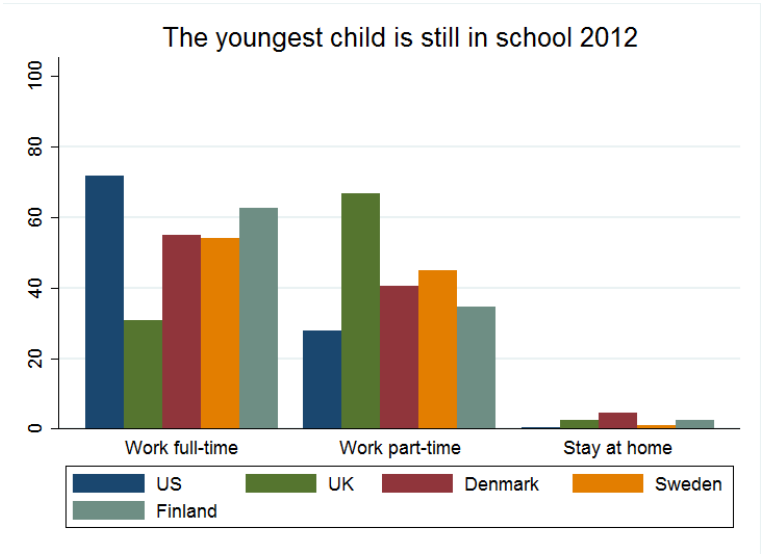

Figure A6: 2012: Do you think that women should work outside the home full-time, part-time or not at all when the youngest child is still in school?

Figure A7: Impact of children on annual labor earnings using the structure of earnings data base with smaller sample size

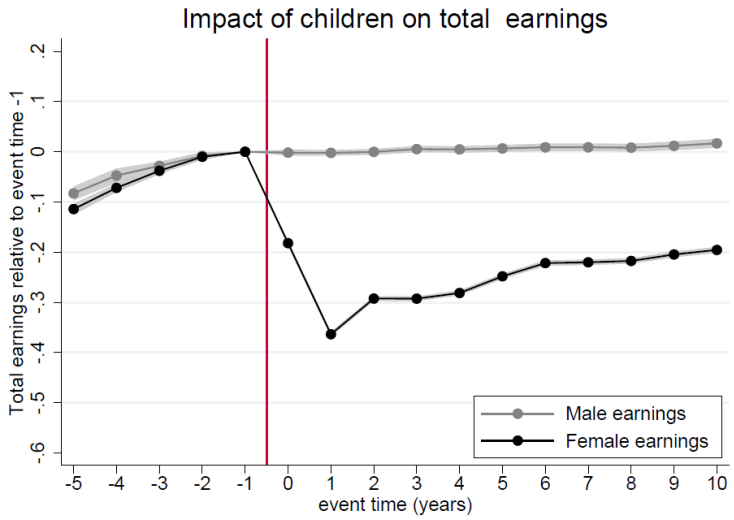

Figure A8: Impact of children on total annual income using the structure of earnings data base with smaller sample size

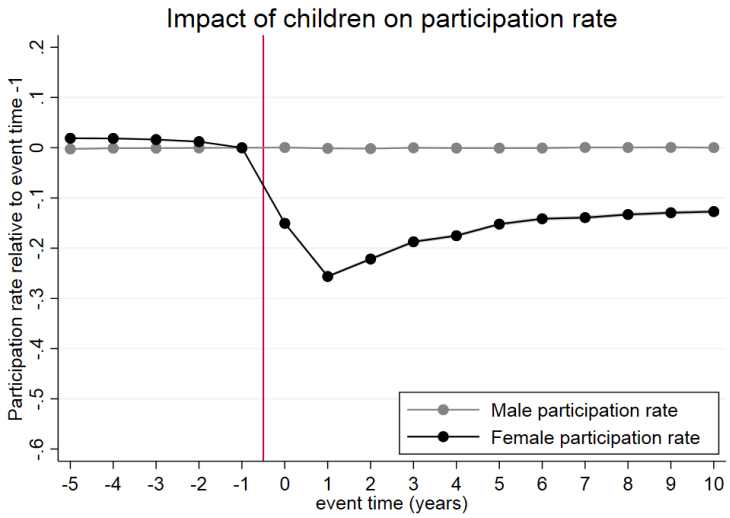

Figure A9: Impact of children on participation rate using the structure of earnings data base with smaller sample size

Table A1: Impact of children on hours worked

Event time	Women	Men	Child penalty
-5	-0.031	-0.016	0.013
-4	-0.019	-0.013	0.004
-3	-0.009	-0.008	-0.0002
-2	0.001	-0.003	-0.004
-1	0	0	0
0	-0.001	-0.003	-0.001
1	-0.040	0.002	0.042
2	-0.030	0.005	0.035
3	-0.032	0.006	0.038
4	-0.032	0.010	0.042
5	-0.029	0.010	0.039
6	-0.025	0.012	0.038
7	-0.045	0.012	0.058
8	-0.034	0.014	0.049
9	-0.026	0.015	0.041
10	-0.023	0.018	0.041

Notes: The outcome variable is monthly hours worked. "Women" and "Men" refers to $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$. "Child penalty" refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

Table A2: Impact of children on wage rates

Event time	Women	Men	Child penalty
-5	-0.036	-0.019	0.014
-4	-0.036	0.008	0.042
-3	-0.048	-0.004	0.040
-2	-0.049	0.002	0.049
-1	0	0	0
0	-0.103	0.018	0.120
1	-0.041	0.044	0.087
2	-0.068	0.035	0.105
3	-0.098	0.030	0.130
4	-0.070	0.036	0.110
5	-0.086	0.035	0.124
6	-0.106	0.053	0.165
7	-0.112	0.028	0.143
8	-0.129	0.031	0.162
9	-0.138	0.032	0.172
10	-0.143	0.030	0.174

Notes: The outcome variable is monthly wage rates. "Women" and "Men" refers to $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$. "Child penalty" refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

Table A3: Impact of children on annual labor earnings - long run

Event time	Women	Men	Child penalty
-5	-0.157	-0.062	0.066
-4	-0.113	-0.042	0.049
-3	-0.065	-0.026	0.026
-2	-0.016	-0.001	0.004
-1	0	0	0
0	-0.535	-0.027	0.414
1	-0.735	-0.022	0.611
2	-0.513	-0.026	0.428
3	-0.487	-0.027	0.412
4	-0.428	-0.035	0.354
5	-0.368	-0.039	0.296
6	-0.325	-0.045	0.249
7	-0.321	-0.054	0.237
8	-0.312	-0.061	0.222
9	-0.288	-0.065	0.195
10	-0.273	-0.068	0.180
11	-0.265	-0.073	0.167
12	-0.260	-0.077	0.161
13	-0.257	-0.081	0.154
14	-0.255	-0.084	0.153
15	-0.253	-0.087	0.151
16	-0.252	-0.084	0.156
17	-0.249	-0.082	0.158
18	-0.247	-0.080	0.160
19	-0.245	-0.080	0.160
20	-0.247	-0.076	0.168

Notes: The outcome variable is annual labor earnings in the long run - up to 20 years after the birth of the first child. "Women" and "Men" refers to $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$. "Child penalty" refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

Table A4: Impact of children on total annual income - long run

Event time	Women	Men	Child penalty
-5	-0.125	-0.055	0.051
-4	-0.091	-0.037	0.039
-3	-0.055	-0.021	0.024
-2	-0.018	-0.008	0.006
-1	0	0	0
0	-0.188	-0.004	0.159
1	-0.335	0.001	0.301
2	-0.280	-0.004	0.252
3	-0.285	-0.006	0.258
4	-0.272	-0.012	0.240
5	-0.248	-0.016	0.214
6	-0.227	-0.022	0.189
7	-0.230	-0.028	0.185
8	-0.229	-0.033	0.179
9	-0.218	-0.037	0.164
10	-0.210	-0.039	0.156
11	-0.208	-0.044	0.148
12	-0.206	-0.046	0.145
13	-0.204	-0.050	0.140
14	-0.204	-0.051	0.140
15	-0.203	-0.052	0.139
16	-0.202	-0.049	0.143
17	-0.201	-0.045	0.148
18	-0.198	-0.040	0.152
19	-0.197	-0.039	0.153
20	-0.199	-0.036	0.161

Notes: The outcome variable is total annual income in the long run - up to 20 years after the birth of the first child. "Women" and "Men" refers to $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$. "Child penalty" refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

Table A5: Impact of children on participation rate - long run

Event time	Women	Men	Child penalty
-5	0.047	0.004	-0.043
-4	0.042	0.002	-0.039
-3	0.034	0.001	-0.033
-2	0.025	-0.0001	-0.025
-1	0	0	0
0	-0.236	-0.001	0.234
1	-0.311	-0.006	0.304
2	-0.276	-0.007	0.268
3	-0.214	-0.005	0.208
4	-0.198	-0.006	0.192
5	-0.172	-0.006	0.166
6	-0.159	-0.006	0.153
7	-0.156	-0.006	0.150
8	-0.150	-0.007	0.144
9	-0.146	-0.007	0.140
10	-0.143	-0.007	0.136
11	-0.141	-0.007	0.134
12	-0.140	-0.007	0.134
13	-0.140	-0.007	0.134
14	-0.139	-0.007	0.133
15	-0.140	-0.007	0.134
16	-0.139	-0.006	0.134
17	-0.138	-0.006	0.133
18	-0.137	-0.005	0.132
19	-0.136	-0.004	0.132
20	-0.135	-0.003	0.132

Notes: The outcome variable is participation rate in the long run - up to 20 years after the birth of the first child. "Women" and "Men" refers to $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$. "Child penalty" refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

Table A6: Impact of children on annual labor earnings - January births

Event time	Women	Men	Child penalty
-5	-0.158	-0.106	0.011
-4	-0.093	-0.067	0.002
-3	-0.036	-0.037	-0.011
-2	0.016	-0.014	-0.031
-1	0	0	0
0	-0.795	-0.043	0.695
1	-0.492	-0.008	0.459
2	-0.450	-0.004	0.428
3	-0.418	0.006	0.412
4	-0.354	-0.003	0.340
5	-0.290	-0.001	0.280
6	-0.254	-0.001	0.245
7	-0.252	-0.004	0.240
8	-0.239	-0.009	0.223
9	-0.213	-0.006	0.200
10	-0.193	-0.006	0.182

Notes: The outcome variable is annual labor earnings for parents with first child birth in January. "Women" and "Men" refers to $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$. "Child penalty" refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

Table A7: Impact of children on total annual income - January births

Event time	Women	Men	Child penalty
-5	-0.146	-0.085	0.028
-4	-0.091	-0.049	0.024
-3	-0.044	-0.027	0.008
-2	-0.003	-0.010	-0.010
-1	0	0	0
0	-0.272	-0.003	0.255
1	-0.282	0.012	0.285
2	-0.244	0.015	0.255
3	-0.256	0.023	0.278
4	-0.231	0.014	0.242
5	-0.200	0.014	0.212
6	-0.181	0.014	0.194
7	-0.184	0.015	0.198
8	-0.178	0.011	0.187
9	-0.164	0.011	0.175
10	-0.151	0.014	0.165

Notes: The outcome variable is total annual income for parents with first child birth in January. "Women" and "Men" refers to $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$. "Child penalty" refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

Table A8: Impact of children on participation rate - January births

Event time	Women	Men	Child penalty
-5	0.091	-0.005	-0.097
-4	0.090	-0.003	-0.092
-3	0.085	-0.003	-0.088
-2	0.079	-0.002	-0.081
-1	0	0	0
0	-0.228	-0.003	0.224
1	-0.205	-0.005	0.200
2	-0.181	-0.004	0.176
3	-0.130	-0.003	0.127
4	-0.105	-0.004	0.101
5	-0.079	-0.002	0.077
6	-0.068	-0.001	0.067
7	-0.065	-0.002	0.063
8	-0.058	-0.001	0.057
9	-0.055	-0.001	0.053
10	-0.049	-0.001	0.048

Notes: The outcome variable is participation rate for parents with first child birth in January. "Women" and "Men" refers to $P_t^g \equiv \alpha_j^g / E[\hat{Y}_{ist}^g | t]$. "Child penalty" refers to $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w | t]}$

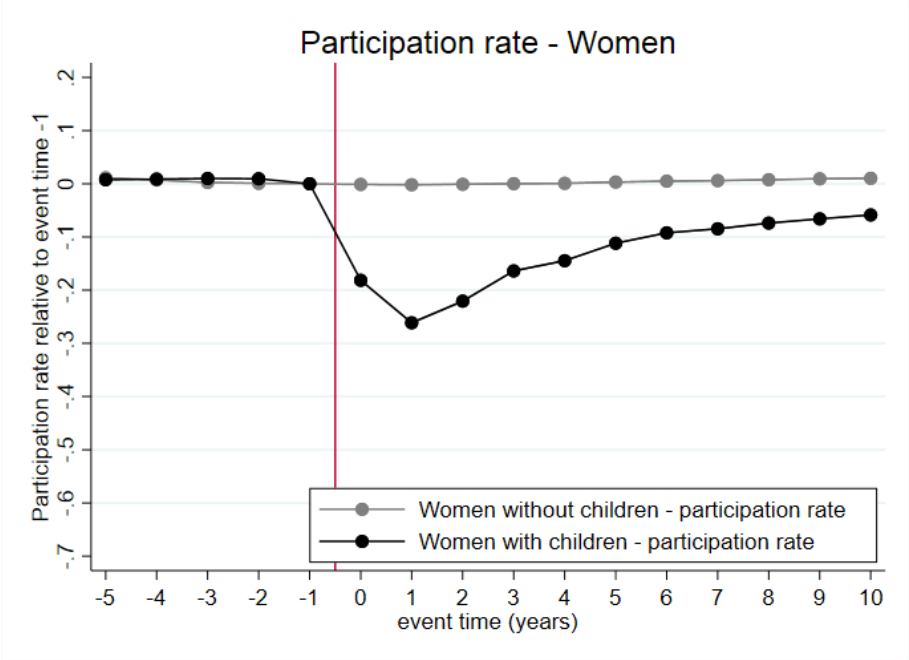

Figure A10: Impact of children on participation rate of women with and without children

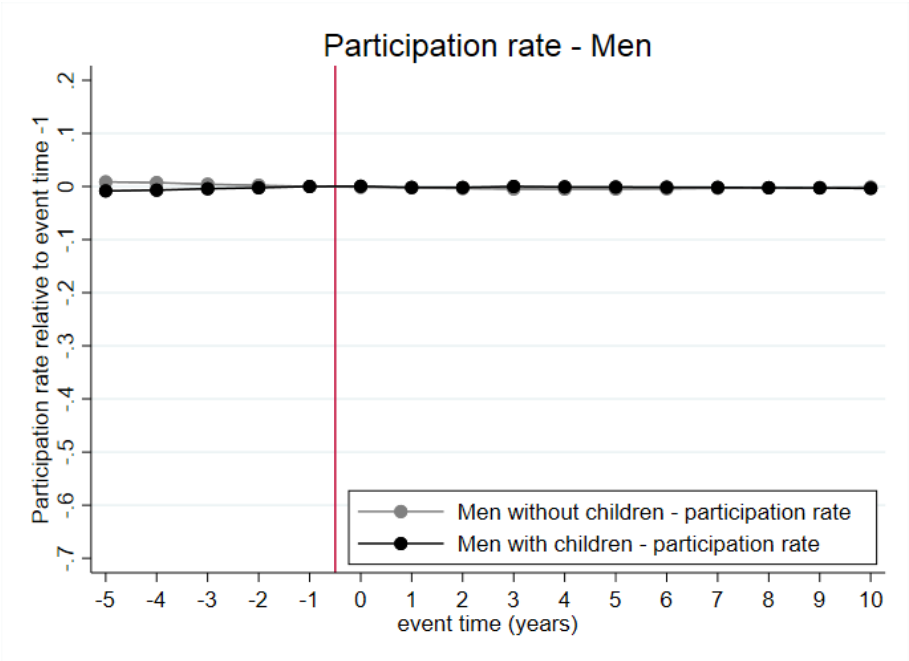

Figure A11: Impact of children on participation rate of men with and without children

Table A9: Difference-in-differences - child penalties in participation rate

Event time	Child penalty - Women	Child penalty - Men
-5	0.003	0.017
-4	-0.002	0.014
-3	-0.008	0.008
-2	-0.009	0.005
-1	0	0
0	0.180	-0.002
1	0.260	-0.001
2	0.220	-0.002
3	0.164	-0.004
4	0.145	-0.004
5	0.115	-0.004
6	0.097	-0.003
7	0.090	-0.001
8	0.081	0.000
9	0.075	0.001
10	0.068	0.002

Notes: "Child penalty - Women" and "Child penalty - Men" are the percentages by which women or men with children fall behind women or men without children in participation rate. More specifically $P_t \equiv \frac{\alpha_t^m - \alpha_t^w}{E[\hat{Y}_{ist}^w|t]}$